

**NATURAL RESOURCES CONSERVATION SERVICE  
CONSERVATION PRACTICE STANDARD AND SPECIFICATIONS**

**FOREST STAND IMPROVEMENT**

(Acre)  
CODE 666

**DEFINITION**

The manipulation of species composition, stand structure and stocking by cutting or killing selected trees and understory vegetation.

**PURPOSE**

- To increase the quantity and quality of forest products, e.g., sawtimber, veneer, wood fiber, poles, pilings, maple syrup, naval stores, nuts and fruits.
- To harvest forest products.
- To initiate forest stand regeneration.
- To reduce the potential of damage from wildfire, pests, and moisture stress.
- To restore natural plant communities.
- To achieve a desired understory plant community.
- To improve aesthetic, recreation, and open space values.
- To improve wildlife habitat.
- To improve water conservation and yield.
- To achieve a desired level of crop tree stocking and density.
- To increase carbon storage in selected crop trees.
- To provide renewable energy production

**CONDITION WHERE PRACTICE APPLIES**

All forest land where improvement of forest resources is needed.

**CRITERIA**

**General Criteria Applicable to All Purposes**

All management decisions shall be based on a woodland inventory and the intended purpose.

Stocking recommendations shall contain stocking in terms of basal area, spacing or trees per acre by species and size class.

Soil erosion, displacement, hydrologic impact and damage to remaining vegetation will not exceed acceptable levels. Minimize disturbances such as rutting, soil compaction, excessive disturbance to the litter layer, and the addition of fill material.

Limit damage to the site by:

- using directional felling
- aligning cut tree stems for efficient skidding
- cutting out forks and large branches
- limiting trails on less than 15% of the site
- logging when the soil is dry or frozen
- using smallest size equipment possible
- using well-organized access trails

The method, felling direction, and timing of tree cutting shall facilitate efficient and safe tree removal and protect sensitive areas such as vernal pools, riparian zones, and cultural resources.

Slash, debris and vegetative material left on the site after treatment will not present a fire or pest hazard or interfere with the intended purpose.

Kill unwanted trees, shrubs, and vines by any of the following means:

- cutting
- girdling
- frilling
- stem injection
- basal bark spray

Mechanical cutting, girdling, and frilling should be followed by a suitable herbicide application to increase mortality and reduce stump sprouting.

When choosing herbicides, review leaching, runoff potential, setback requirements, persistence, and toxicity ratings of chemical formulations. Use the safest available herbicide. Pesticides used improperly can be injurious to man, animals, and plants. *Follow all label directions and label precautions.*

Base forest stand improvement choices on:

- relative tree position
- crown position
- crown condition
- tree health
- stem quality
- species

Field Office Technical Guide Section II, County Soil Information, Forest Land Interpretations or Conservation Tree and Shrub Groups should be used in determining desirable tree species and estimating potential site productivity.

Protect riparian zones, unique areas, and structures. Leave a strip of existing woody vegetation, a minimum 50 feet wide, along any non-woodland border. This strip will provide wind protection for the remaining stand, provide food and cover for wildlife, improve visual aesthetics, and protect water quality. Some light forest stand improvement work can be done in this strip. Where riparian protection is needed, follow RIPARIAN FOREST BUFFER (391).

Release cuttings should generally be done before the stand is 15 years old or as soon as the need becomes apparent. Cut or deaden:

- cull and "wolf" trees (may be retained for wildlife)
- undesirable species
- damaged or diseased trees
- surplus sprouts

Comply with applicable laws and regulations.

Prescribed fire may be used to:

- remove undesirable hardwoods;
- reduce fuel build-up;
- expose mineral soil for improved germination;
- adjust community structure and composition.

Refer to PRESCRIBED BURNING (338) for additional guidance. A prescribed burn plan shall be prepared.

Protect the area from grazing with exclusion or for silvopasture activity, controlled grazing.

### Additional Criteria to Improve or Sustain Timber Production

*All stands:*

Start thinning at an early age when the activity is expected to produce the desired effect on the targeted size class(es) and species. Additional thinning can occur at 10-15 year intervals, up until three-fourths of the rotation age is reached for even-aged stands. For uneven-aged stands additional forest stand improvements can occur at 10-20 year intervals, indefinitely.

Keep improvement cuttings light enough (maintain at least 60% stocking) to restrict the growth of any undesirable species, to maintain full site utilization, to reduce sunscald damage and to reduce epicormic (a shoot sprouting from a dormant bud on the stem of a tree) branching and basal sprouting.

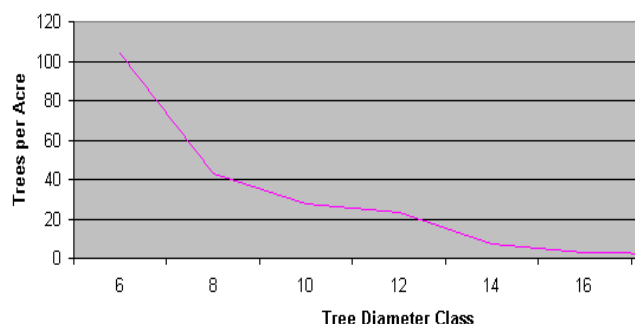
For even-aged stands with an average DBH of 6 inches or more, use the following table as a guide for residual stocking after thinning:

Stand Diameter (inches)	Spacing (feet)	Basal Area (sq. ft.)	Trees/Acre (no.)
<b>Hardwood</b>			
6	13	55	258
8	16	60	170
10	19	65	121
<b>Pine</b>			
6	12	60	304
8	14	75	222
10	16	90	170

For uneven-aged stands create or maintain age classes which occupy an equal amount of ground space per acre. Each improvement activity should:

- regenerate a new age/size class (if needed)
- harvest mature trees and excess numbers in each age class
- balance the diameter class distribution (see following chart)

Diameter Distribution of an Uneven-Aged Stand



Cut among the age/size classes according to the following priority:

- remove the defective and diseased trees
- remove high risk trees that might not survive another cutting cycle
- remove low value trees of any species
- thin the least desirable species.
- remove excess numbers of desired species

With all thinning, provide at least 3 to 5 feet of crown growing space on a minimum of two sides of residual trees (5 to 10 feet for black walnut).

Thin stands below 6 inches DBH to a 10-foot spacing.

Strip or row thinning is possible in plantations with straight rows. Remove one-third of the stand or every third row.

#### *Pine stands:*

Where root rot (*Fomes annosus*) may be a problem, restrict thinning to the summer months to minimize infection. Treat cut stumps with borax.

#### **Additional Criteria to Achieve a Desired Level of Crop Tree Stocking and Density**

Select 20 to 75 crop trees per acre based on the following criteria:

- Dominant or codominant canopy tree
- Healthy crown
- Minimal epicormic branching
- Good form
- Free of defects and disease
- Desired species
- Adapted species

Remove all trees in direct adjacent competition with the crop trees. Provide at least 10 to 15 feet of crown growing space on all sides of residual crop trees.

#### **Additional Criteria to Improve Wildlife Habitat**

Rotate forest stand improvements throughout the forest so that various stages of plant succession will be established.

#### *Wildlife as a Secondary Objective*

Leave or establish 3 snags and 3 den trees per acre, ranging in size from 6 to 20 inches DBH. Leave 2 to 4 vines per acre. Favor trees with vines that will be left as den trees or oak species greater than 10 inches DBH.

Create 2 or 3 brush piles per acre with material from forest stand improvement work.

#### *Wildlife as a Primary Objective*

Perform heavier thinning (less than 60% stocking) to encourage fuller crown development, earlier seed production, and heavier herbaceous plant development.

Favor hard-mast producers (oak, hickory, pecan and walnut) and conifers.

Leave or establish 7 snags and 7 den trees per acre, ranging in size from 6 to 20 inches DBH.

Leave 4 to 6 vines per acre. Favor trees with vines that will be left as den trees or oak species greater than 10 inches DBH.

Create 3 to 4 brush piles per acre with material removed during improvement work. Hinged, partially cut "living" brushpiles should be included to provide long-lived shelter.

Low intensity prescribed fires may be used to improve/increase green browse for wildlife. Refer to PRESCRIBED BURNING (338) for additional guidance. A prescribed burn plan shall be prepared.

For additional management guidelines refer to WILDLIFE UPLAND HABITAT MANAGEMENT (645).

### Additional Criteria to Improve Aesthetics and Recreation

This activity is strongly influenced by subjective values and interests. Direct forest stand improvements toward:

- opening vistas
- installing trails
- increasing vegetation diversity (shape, texture, color, size)
- removing safety hazards near pedestrian use areas (snags, large dead limbs, etc.)
- creating visual screens

For additional guidelines refer to RECREATION AREA IMPROVEMENT (562) and RECREATION TRAIL AND WALKWAY (568).

### Additional Criteria to Increase Carbon Storage

For optimal carbon sequestration, select plants that have higher rates of sequestration and are adapted to the site to assure strong health and vigor.

Maintain optimum stocking rate for the site.

### CONSIDERATIONS

These specifications are intended to help identify and determine basic forest stand improvement activities. Consult a professional forester for assistance in the planning and implementation of complex sites.

Pine stands with known occurrences of root rot should be considered high risk stands.

Forested wildlife corridors can minimize fragmentation effects.

Forest stand improvement activity for *sawtimber/veneer* production is generally not justified on poor sites (below site index 55 if managing for oaks; or site index 45 if managing for shortleaf pine).

Forest stand improvement activity can impact water quality by causing a temporary increase in erosion rates and sediment yield.

If chemicals are used to control vegetation, the potential for surface and/or ground water contamination exists. Seek guidance from

experienced pesticide advisors such as university extension or certified crop specialists.

The practice should be timed to minimize disturbance of seasonal wildlife activities.

Consider wildlife food and cover needs when making modifications to forest composition and tree spacing.

Successful regeneration of desirable species is usually dependent upon timely application of forest stand improvement.

### PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, and narrative statements in the conservation plan, or other acceptable documentation.

### OPERATION AND MAINTENANCE

Periodic inspections during treatment activities are necessary to ensure that objectives are achieved and resource damage is minimized.

### REFERENCES

*Forestry Handbook, Second Edition; Society of American Foresters; 1984.*

*Increased Woodland Products through Timber Stand Improvement; Agricultural Guide 5150; University of Missouri Extension Division; 1984.*

*Managers Handbook for Oaks in the North Central States; General Technical Report NC-37; North Central Forest Experiment Station, Forest Service, USDA; 1977.*

*Managers Handbook for Black Walnut; General Technical Report NC-38; North Central Forest Experiment Station, Forest Service, USDA; 1977.*

*Managing Shortleaf Pine in Missouri; Station Bulletin 875; Agricultural Experiment Station, University of Missouri; 1969.*

*Managing Forests to Maintain Populations of Gray and Fox Squirrels; Technical Bulletin 5; Illinois Department of Conservation; 1987.*

*The Practice of Silviculture; David M. Smith; John Wiley & Sons, Eighth Edition; 1986.*

*Snag and Den Tree Management; Timber and Wildlife Benefits on Private Land-No.5; Missouri Conservation Commission; 1985.*

*Working with Your Woodland-A Landowner's Guide; Beattis, Thompson, and Levin; University Press of New England; 1983.*

*Central Hardwood Notes. Jay Hutchinson, Editor. USDA Forest Service. North Central Forest Experiment Station; 1989.*

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